

What is Claimed Is:

1. An analysis model data creating method for creating an analysis model data using an arithmetic device, comprising:
  - a shape data readout step of reading out shape data
  - 5 defining a surface shape of an analysis target;
  - a voxel data generating step of generating voxel data in which the shape data read out at the shape data readout step are embraced by a set of voxels that are rectangular parallelopiped; and
- 10 an interference polygon creating step of creating, for each voxel interfering with the shape data read out at said shape data readout step, an interference polygon inside the shape data using interference surfaces between the shape data and the interior of the voxel,
- 15 the method further comprising:
  - after the interference polygon creating step, a divided polygon creating step of moving one of the vertexes of the interference polygon which has a predetermined property, to another vertex and creating a divided polygon having as
  - 20 vertexes said vertex that has not been moved and vertexes of the voxel inside said shape data; and
  - an element extracting step of extracting an element of a predetermined shape on the basis of a relationship between a plurality of vertexes of the divided polygon created at the
  - 25 divided polygon creating step.

2. The analysis model data creating method according to Claim 1, wherein said divided polygon creating step includes

a particular-vertex moving step of moving vertexes of the interference polygon which are not located on any side of said voxel, to an on-side intersection that is an intersection between said interference surface and a side of said voxel.

3. The analysis model data creating method according to Claim 1, wherein said element extracting step includes an extraction preprocess step of defining for element extraction straight lines between the vertexes of said divided polygon and a surface containing some of the vertexes and which is parallel with any of said voxel surfaces.

4. The analysis model data creating method according to Claim 1, wherein said element extracting step comprises a top and bottom surface setting step of setting a bottom surface and a top surface corresponding to the bottom surface in said divided polygon, a vertex allotting step of allotting the vertexes of said divided polygon to the top surface side and bottom surface side set at the top and bottom surface setting step, a top and bottom surface vertex pair identifying step of identifying correspondences between the vertexes on the top and bottom surface sides which have been allotted at the vertex allotting step, and a pair-used extracting step of extracting an element of a predetermined shape from the divided polygon using the top and bottom surface pairs identified at the top and bottom surface vertex pair identifying step.

5. An analysis model data creating method for creating an analysis model data using an arithmetic device, comprising:

a shape data readout step of reading out shape data defining a surface shape of an analysis target;

5 a voxel data generating step of generating voxel data in which the shape data read out at the shape data readout step are embraced by a set of voxels that are rectangular parallelopiped; and

10 an interference polygon creating step of creating, for each voxel interfering with the shape data, an interference polygon inside the shape data using interference surfaces between the shape data and the interior of the voxel,

the method further comprising:

15 after the interference polygon creating step, a divided polygon creating step of moving vertexes of the interference polygon which are not located on any side of said voxel, to an on-side intersection that is an intersection between said interference surface and a side of said voxel, and creating a divided polygon having as vertexes the on-side intersection 20 and vertexes of the voxel inside said shape data; and

an element extracting step of extracting an element of a predetermined shape using a plurality of vertexes of the divided polygon created at the divided polygon creating step and a voxel surface inside said shape data or a plane which 25 is perpendicular to an internal voxel surface, a partial area of the voxel surface, and which contains said vertexes.

6. The analysis model data creating method according to Claim 5, wherein said element extracting step comprises:

a bottom surface setting step of identifying one internal voxel surface of said divided polygon which has a predetermined  
5 property and setting the identified internal voxel surface as a bottom surface;

a top surface setting step of identifying a top surface corresponding to the bottom surface set at the bottom surface setting step;

10 a top and bottom surface allotting step of allotting all the vertexes of said divided polygon to the top surface side and the bottom surface side; and

an extraction preprocess step of defining a plane perpendicular to said internal voxel surface on the basis of  
15 a relationship between the vertexes allotted to the bottom and top surfaces at the top and bottom surface allotting step.

7. The analysis model data creating method according to Claim 6, wherein said extraction preprocess step comprises:

a vertex retrieving line scanning step of generating a vertex retrieving line perpendicular to said bottom surface and scanning the vertex retrieving line on a side of said divided polygon corresponding to said bottom surface thereof;

10 a pair number applying step of applying, if any vertex of said divided polygon is discovered while the vertex retrieving line is being scanned during the vertex retrieving line scanning step, a pair number to the vertex retrieving line at the position of the discovery;

a pair generating step of generating, after completion of the scanning by said vertex retrieving line scanning step,

15 pairs of vertexes on the bottom surface side and vertexes on  
the top surface side on the basis of a plurality of lines to  
which the pair numbers have been applied and of the presence  
of said vertexes on the bottom surface side and said vertexes  
on the top surface side for each of the lines;

a projective-point setting step of setting, if an  
intersection between said line imparted with the pair number  
and having a vertex that has not been paired at the pair  
generating step and a side of the divided polygon is inside  
said shape data, this intersection as a projective point; and  
a plane defining step of adding the projective point and  
a vertex corresponding to the projective point as said pair  
and defining a plane for element extraction on the basis of  
a relationship between the paired vertexes.

8. The analysis model data creating method according to Claim 6, wherein said element extracting step includes a bottom surface changing step of changing the bottom surface of divided polygons from which elements cannot be extracted  
5 and retrying the extraction process on the basis of the changed bottom surface.

9. The analysis model data creating method according to Claim 5, wherein said divided polygon creating step includes a contraction process step of contracting the on-side intersection to said vertex of the voxel if a distance from  
5 said on-side intersection to said voxel vertex is shorter than a predetermined contraction distance.

10. The analysis model data creating method according to Claim 9, further comprising, after said element extracting step, a contraction distance changing step of making such a change that the contraction distance of divided polygons from which elements cannot be extracted is increased and retrying said process for generating a divided polygon, on the basis of the changed contraction distance.

11. The analysis model data creating method according to Claim 5, wherein said element extracting step includes a distorted shape excluding step of executing, if an extracted element has a predetermined distorted shape, a process of not extracting the distorted shape as an element.

12. The analysis model data creating method according to Claim 5, wherein said interference polygon creating step comprises:

a processed voxel extracting step of extracting a voxel  
5 interfering with said shape data as a processed voxel;

an intra-voxel intersection determining step of determining, if any vertex from the shape data is present inside the processed voxel, this vertex as an intra-voxel intersection;

10 an intra-surface intersection determining step of  
determining, if any intersection between a surface of said  
processed voxel and a side of said shape data is present, this  
intersection as an intra-surface intersection;

an on-side intersection determining step of determining,  
15 if any intersection between a side of said processed voxel

and a surface of said shape data is present, this intersection  
as an on-side intersection; and

an interior and exterior determining value applying step  
of applying an interior and exterior determining value for  
20 interior and exterior determination to each of said intra-voxel  
intersection, said intra-surface intersection, and said  
on-side intersection on the basis of front and back information  
contained in said shape data.

13. A recording medium on which an analysis model data  
creating program for creating analysis model data using an  
arithmetic device is recorded, the program comprising as  
instructions to operate said arithmetic device:

5 a shape data readout instruction to read out shape data  
defining a surface shape of an analysis target;

a voxel data generating instruction to generate voxel  
data in which the shape data read out by said arithmetic means  
in response to the shape data readout instruction are embraced  
10 by a set of voxels that are rectangular parallelopiped;

an interference polygon creating instruction to create,  
for each voxel interfering with the shape data, an interference  
polygon inside the shape data using interference surfaces  
between the shape data and the interior of the voxel;

15 a divided polygon creating instruction to move a vertex  
of the interference polygon which is not located on any side  
of said voxel, to an on-side intersection that is an  
intersection between said interference surface and a side of  
said voxel, and creating a divided polygon having as vertexes

20 the on-side intersection and vertexes of the voxel inside said shape data; and

an element extracting instruction to extract an element of a predetermined shape using a plurality of vertexes of the divided polygon created in response to the divided polygon  
25 creating instruction and a voxel surface inside said shape data or a plane which is perpendicular to an internal voxel surface, a partial area of the voxel surface, and which contains said vertexes.

14. An analysis model data creating apparatus,  
comprising:

shape data readout means for reading out shape data defining a surface shape of an analysis target;

5 voxel data generating means for generating voxel data in which the shape data read out by the shape data readout means are embraced by a set of voxels which are rectangular parallelopiped;

analysis model data generating means for generating  
10 analysis model data from the voxel data generated by the voxel data generating means; and

analysis model data display means for displaying the analysis model data generated by the analysis model data generating means,

15 wherein said analysis model data generating means comprises an interference polygon creating section for creating, for each voxel interfering with the shape data read out by said shape data readout means, an interference polygon

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inside the shape data using interference surfaces between the  
20 shape data and the interior of the voxel, a divided polygon  
creating section for moving one of the vertexes of said  
interference polygon which has a predetermined property, to  
another vertex, and creating a divided polygon having as  
vertexes the on-side intersection and vertexes of the voxel  
25 inside said shape data, and an element extracting section for  
extracting an element of a predetermined shape on the basis  
of a relationship between a plurality of vertexes of the divided  
polygon created by the divided polygon creating section.